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Outbreak report

Norwalk-like Viral Gastroenteritis Outbreak among US Army Trainees, Fort Bliss, Texas

Introduction: Between 27 August and 1 September 1998, 99 soldiers assigned to the Fort Bliss Air Defense Artillery Training Center in El Paso, Texas were hospitalized for acute gastroenteritis (AGE). In order of descending frequency, their symptoms were acute onset of nausea, vomiting, abdominal pain, diarrhea and fever (table 1).

Table 1. Presenting symptoms among hospitalized soldiers, 1998 Fort Bliss AGE outbreak

Symptom	Number (from 90)	Percent (%)
Nausea	79	88
Vomiting	72	80
Abdominal pain	68	76
Diarrhea	60	67
Fever/chills	37	41
Headache	20	22
Photophobia/eye pain	3	3

Initial clinical evaluations suggested the diagnosis of acute viral gastroenteritis. The median duration of hospitalizations was 24 hours (range: 12-72 hours). All soldiers admitted to the local William Beaumont Army Medical Center (WBAMC) were assigned to the same unit and lived in close proximity within the training area compound (a five-by-three-building rectangular compound that was segregated from the rest of the Fort Bliss installation). The hospitalization rate for AGE in the affected unit was 12% (99/835). Two dining facilities, "DF1" and "DF2," were located across from each other in the center of the compound. While some soldiers expressed a preference for one or the other, they generally dined where directed by their drill instructors or where the line was shorter.

Outbreak investigation: Between 30 August and 2 September 98, an Epidemiologic Consultation (EPICON) team conducted interviews with patients, food handlers, facility engineers, public health officers and training unit officers. The epidemic nature of the recent AGE experience was documented by reviewing WBAMC hospitalization records for AGE during the previous year (figure 1). Inspection tours of the training compound and both dining facilities were conducted, and training schedules, daily personnel status reports, sign-in rosters, menus, and meal preparation documents were collected and reviewed. Interviews with food handlers revealed that a confection baker became extremely ill in the DF1 facility while baking during the early morning of 26 August. Another DF1 employee, a housekeeper (non-food handler), also reported a self-limited gastrointestinal illness between 27 and 29 August. No workers in DF2 reported illnesses in the relevant period. Limited food samples and cultures of the ice cream

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and soft drink fountains were sent for analysis. In general, the sanitation of the DFs was satisfactory. In particular, no sinks or hoses presented back-siphoning hazards, and soft drink dispensers had anti-siphoning valves in place. Water samples were taken from multiple sites throughout the training compound and the rest of the Fort Bliss installation.

A food-borne outbreak questionnaire was developed and administered to 323 soldiers. Of the questionnaire respondents, 86 cases had been hospitalized with AGE, and 237 "controls" were randomly selected from the training unit. The questionnaire was designed with a food preference format based on foods listed on the previous week's menus.

The case definition for AGE was three or more loose diarrheal stools and/or vomiting within a 24 hour period in the week prior to the outbreak, and/or admission to the hospital for AGE. Forty (16.9%) of the 237 controls met the case definition for AGE. Assuming that unreported illness was uniformly distributed among the 736 non-hospitalized soldiers in the training unit, and adding this estimate to the 99 known cases, the overall attack rate was estimated as 26.7% {[(0.169)(736)+99]/835 = 26.7%}. An epidemiologic curve constructed from the 126 identified cases of AGE is shown in figure 2. In an effort to determine the point source of the outbreak, cases with onsets of symptoms on 27-28 August were considered the "first wave" – first

Continued on page 8

Figure 1. Cases of AGE admitted to WBAMC, year prior to Norwalk-like outbreak

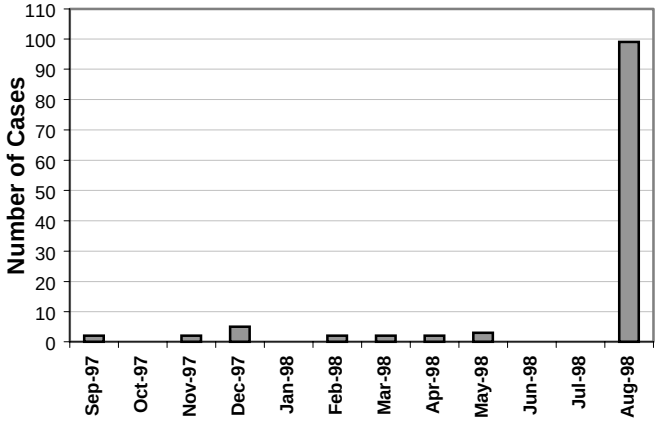


Figure 2. Date of onset of AGE symptoms in 126 cases, 24 August - 3 September 1998

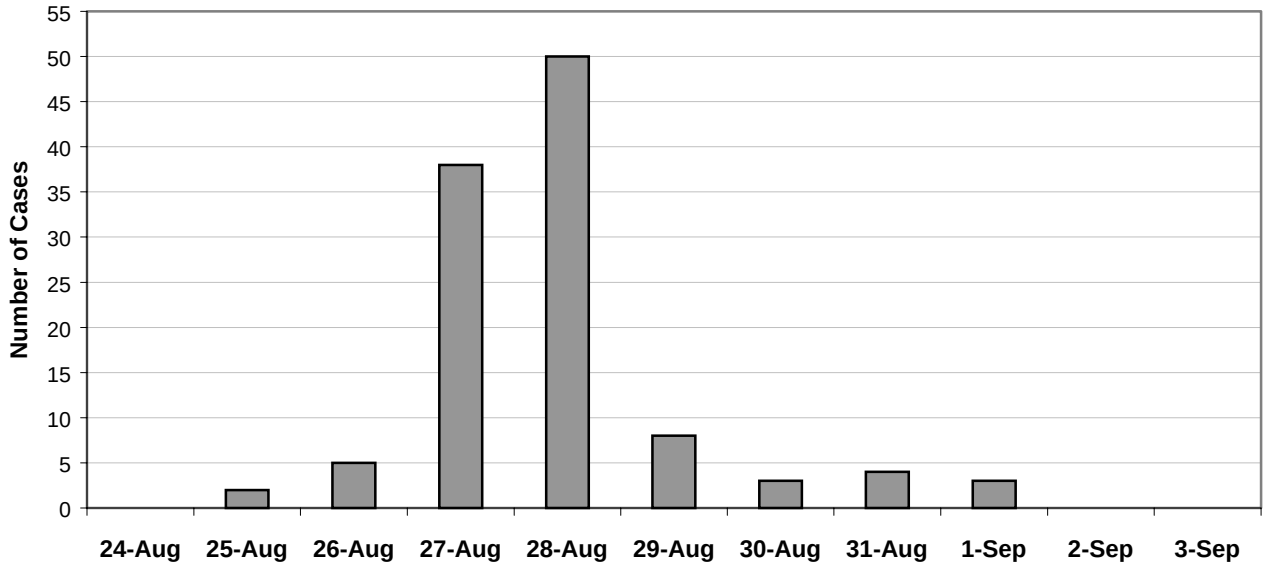


TABLE I. Selected sentinel reportable diseases, US Army medical treatment facilities*
October, 1998

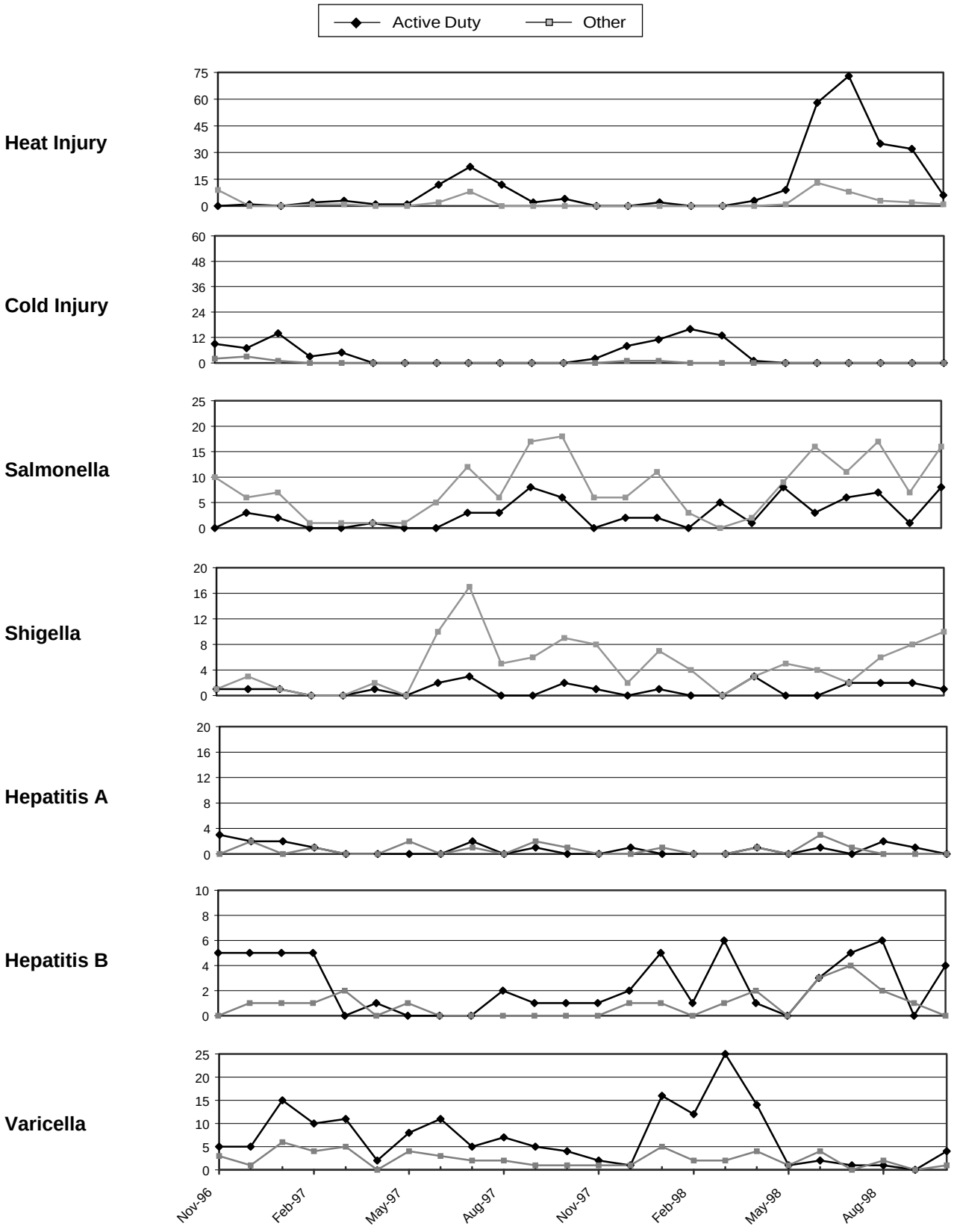
Reporting MTF/Post**	Total number of reports submitted October 1998	Environmental Injuries		Viral Hepatitis		Salmonellosis		Shigella		Varicella	
		Active Duty				Active Duty	Other	Active Duty	Other	Active Duty	Other Adult
		Heat	Cold	A	B						
		Cum. 1998	Cum. 1998	Cum. 1998	Cum. 1998	Cum. 1998	Cum. 1998	Cum. 1998	Cum. 1998	Cum. 1998	Cum. 1998
NORTH ATLANTIC RMC											
Walter Reed AMC	15	0	0	2	0	3	6	0	0	4	0
Aberdeen Prov. Ground, MD	4	1	0	0	2	0	0	0	0	0	0
FT Belvoir, VA	17	0	0	0	0	0	9	0	1	1	0
FT Bragg, NC	210	126	1	0	8	16	35	2	17	0	0
FT Drum, NY	23	0	14	0	2	0	1	0	0	2	4
FT Eustis, VA	36	13	0	0	0	0	3	1	4	5	2
FT Knox, KY	24	5	0	0	0	0	0	0	0	18	0
FT Lee, VA	2	0	0	0	2	0	0	0	0	0	0
FT Meade, MD	7	0	0	0	0	0	1	0	0	5	1
West Point, NY	5	0	0	1	1	0	1	0	0	0	1
GREAT PLAINS RMC											
Brooke AMC	21	1	0	4	2	1	6	0	1	2	0
Beaumont AMC	16	0	0	0	0	0	3	0	3	9	1
FT Carson, CO	13	5	2	0	0	1	2	0	0	3	0
FT Hood, TX	28	9	0	0	11	0	1	1	2	2	1
FT Huachuca, AZ	2	0	0	0	0	0	2	0	0	0	0
FT Leavenworth, KS	1	0	0	0	0	0	1	0	0	0	0
FT Leonard Wood, MO	28	5	1	0	0	1	0	0	0	14	7
FT Polk, LA	18	11	0	0	0	0	0	0	0	0	0
FT Riley, KS	9	0	1	0	0	1	0	1	3	3	0
FT Sill, OK	24	11	0	0	10	0	2	0	0	1	0
SOUTHEAST RMC											
Eisenhower AMC	4	3	0	0	1	0	0	0	0	0	0
FT Benning, GA	42	23	1	0	2	1	5	0	3	2	0
FT Campbell, KY	30	1	1	0	0	1	3	3	16	1	4
FT Jackson, SC	14	3	1	2	0	0	2	0	1	5	0
FT McClellan, AL	6	6	0	0	0	0	0	0	0	0	0
FT Rucker, AL	0	0	0	0	0	0	0	0	0	0	0
FT Stewart, GA	36	28	1	0	1	0	0	0	2	3	0
WESTERN RMC											
Madigan AMC	7	0	0	0	0	0	3	0	1	3	0
FT Irwin, CA	2	0	0	0	2	0	0	0	0	0	0
FT Wainwright, AK	11	0	9	0	2	0	0	0	0	0	0
OTHER LOCATIONS											
Tripler	13	1	0	1	3	0	6	0	1	0	0
Europe	117	1	22	3	24	30	23	1	0	7	5
Korea	26	7	0	4	13	0	0	0	0	1	0
Total	**811**	**260**	**54**	**17**	**86**	**55**	**115**	**9**	**55**	**91**	**26**

* Based on date of onset.

** Reports are included from main and satellite clinics. Not all sites reporting.

Date of Report: 7-Nov-98

FIGURE I. Selected sentinel reportable diseases, US Army medical treatment facilities*
Cases per month, Nov 96 - Oct 98



* Reports are included from main and satellite clinics. Not all sites reporting.

Date of report: 7-Nov-98

TABLE II. Reportable sexually transmitted diseases, US Army medical treatment facilities*
October, 1998

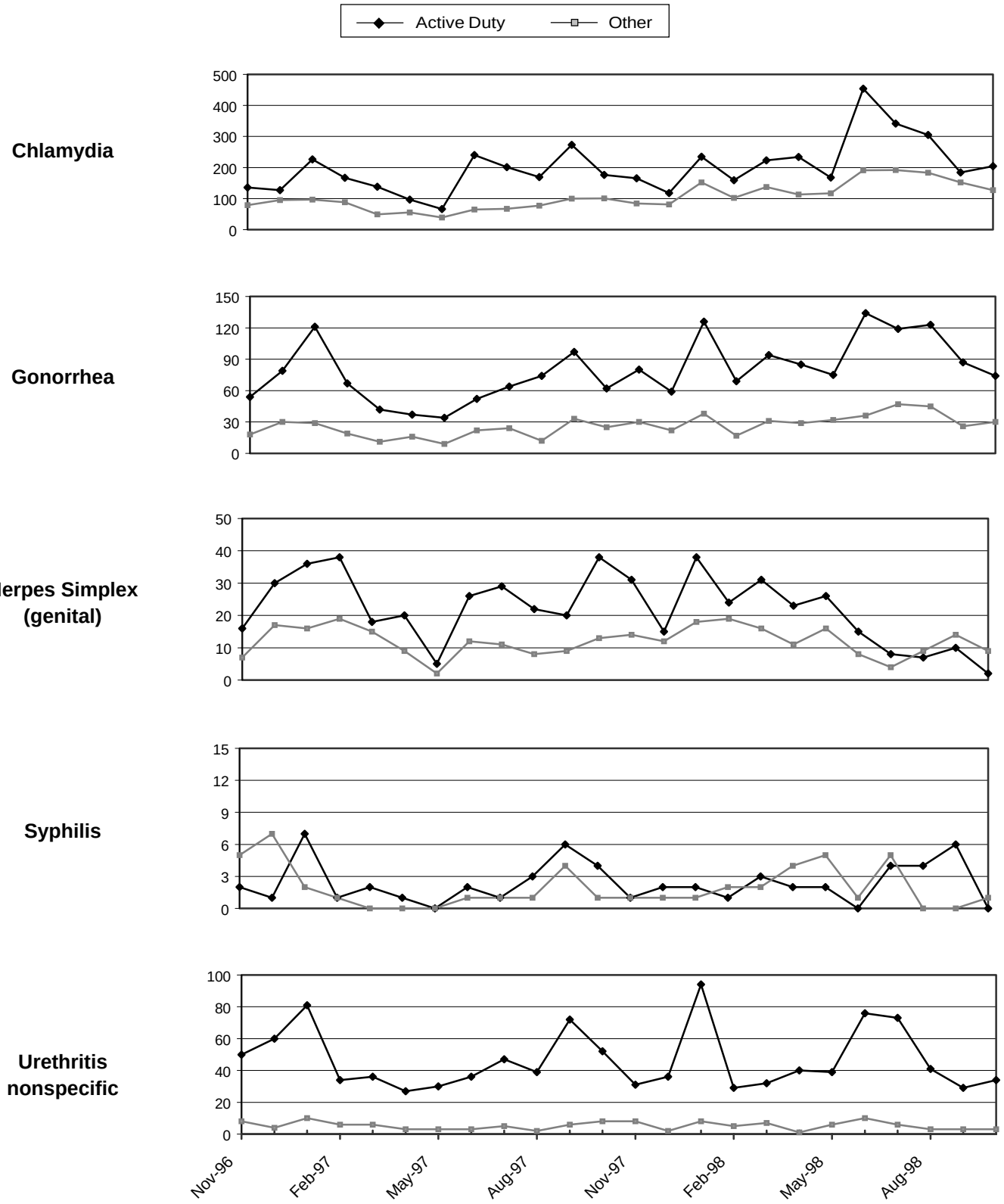
Reporting MTF/Post**	Chlamydia		Urethritis non-spec.		Gonorrhea		Herpes Simplex		Syphilis Prim/Sec		Syphilis Latent		Other STDs**	
	Cur. Month	Cum. 1998	Cur. Month	Cum. 1998	Cur. Month	Cum. 1998	Cur. Month	Cum. 1998	Cur. Month	Cum. 1998	Cur. Month	Cum. 1998	Cur. Month	Cum. 1998
NORTH ATLANTIC RMC														
Walter Reed AMC	6	67	1	11	1	25	0	10	0	1	1	4	0	2
Aberdeen Prov. Ground, MD	0	23	0	2	1	5	0	1	0	0	0	0	0	0
FT Belvoir, VA	10	137	0	0	2	39	4	44	0	4	0	0	0	13
FT Bragg, NC	37	44	0	0	7	11	0	0	0	0	0	0	1	1
FT Drum, NY	2	90	0	4	2	44	0	9	0	1	0	1	0	0
FT Eustis, VA	16	110	0	0	4	49	0	0	0	0	0	2	0	0
FT Knox, KY	12	154	0	0	0	47	0	28	0	0	0	1	0	0
FT Lee, VA	4	37	0	0	0	20	0	0	0	2	0	0	0	0
FT Meade, MD	1	54	0	34	0	11	0	25	0	3	0	0	0	0
West Point, NY	1	24	0	0	0	6	0	4	0	0	0	0	0	0
GREAT PLAINS RMC														
Brooke AMC	12	145	0	0	1	41	0	1	0	1	0	0	0	0
Beaumont AMC	9	243	0	0	2	64	0	18	0	1	0	2	0	1
FT Carson, CO	33	418	3	105	4	88	0	18	0	1	0	0	0	0
FT Hood, TX	16	856	6	237	5	380	0	48	0	2	0	3	0	3
FT Huachuca, AZ	0	21	0	0	0	9	0	0	0	0	0	0	0	0
FT Leavenworth, KS	1	25	0	0	0	2	0	0	0	0	0	0	0	0
FT Leonard Wood, MO	10	92	0	24	2	33	0	0	0	0	0	0	0	1
FT Polk, LA	22	124	0	0	9	35	0	1	0	1	0	0	0	0
FT Riley, KS	14	212	0	0	4	66	0	1	0	1	0	0	0	0
FT Sill, OK	3	122	5	36	4	85	0	7	0	0	0	0	0	3
SOUTHEAST RMC														
Eisenhower AMC	8	204	0	0	0	26	0	22	0	0	0	0	0	0
FT Benning, GA	17	177	0	3	9	68	0	15	0	0	0	0	0	0
FT Campbell, KY	19	321	0	0	14	142	0	9	0	1	0	1	0	0
FT Jackson, SC	8	201	0	0	5	82	0	3	0	0	0	0	0	5
FT McClellan, AL	2	14	0	0	0	7	0	0	0	0	0	0	0	0
FT Rucker, AL	0	30	0	0	0	5	0	3	0	0	0	0	0	0
FT Stewart, GA	13	122	15	151	11	105	0	46	0	0	0	2	0	0
WESTERN RMC														
Madigan AMC	21	303	7	124	6	45	0	14	0	0	0	1	0	0
FT Irwin, CA	0	26	0	0	0	4	0	0	0	0	0	0	0	0
FT Wainwright, AK	0	39	0	0	0	3	0	2	0	0	0	0	0	0
OTHER LOCATIONS														
Tripler	19	257	0	0	9	77	7	84	0	0	0	1	0	0
Europe	9	618	0	0	2	112	0	22	0	11	0	1	0	4
Korea	6	63	0	0	0	20	0	7	0	2	0	0	0	0
Total	**331**	**5373**	**37**	**731**	**104**	**1756**	**11**	**442**	**0**	**32**	**1**	**19**	**1**	**33**

* Reports are included from main and satellite clinics. Not all sites reporting.

Date of Report: 7-Nov-98

** Other STDs: (a) Chancroid (b) Granuloma Inguinale (c) Lymphogranuloma Venereum (d) Syphilis unspec. (e) Syph, tertiary (f) Syph, congenital

FIGURE II. Reportable sexually transmitted diseases, US Army medical treatment facilities*
Cases per month, Nov 96 - Oct 98



* Reports are included from main and satellite clinics. Not all sites reporting.

Date of report: 7-Nov-98

Continued from page 3

wave cases were considered separately in analyses of potentially high risk exposures (table 2).

Questionnaire, culture results: There was nearly a tenfold increase in AGE risk among soldiers who ate at DF1 in the week prior to the outbreak (odds ratio: 9.8, 95% CI: 2.8, 40.2). Several food items and the soda fountain dispenser in DF1 were also statistically associated with AGE risk (table 2). All post water samples were negative for significant contaminants, cultures of food specimens revealed only non-pathogenic coliform bacteria (suggestive of incidental contamination), and stool samples from hospitalized cases were negative for bacterial and parasitic pathogens. Of 20 specimens sent to the Centers for Disease Control and Prevention (CDC) in Atlanta, 15 were positive by reverse transcriptase polymerase chain reaction (PCR) assay for Norwalk-like calicivirus (genotype 2).

Discussion: Norwalk-like viral agents, or Small Round-Structured Viruses (SRSVs), are transmitted by the fecal-oral route via contaminated water and food.[1-4] Since the sequencing of the Norwalk virus genome, the members of the Norwalk virus group have been divided into two genotypes, with the Norwalk virus representing the prototypical virus of the G-2 genotype.[5] The G-2 viruses are the most common cause of viral gastroenteritis outbreaks in adults, and include viruses previously known collectively as the 26-35 nm SRSVs.[1,6] These viruses are now classified as members of the calicivirus family.[1,5,6] Norwalk and Norwalk-like viruses have been identified in 42-60% of viral food- and water-borne gastroenteritis outbreaks since the prototypical Norwalk virus was first visualized by immune electron microscopy in 1972.[1,2] SRSV outbreaks are most often associated with raw shellfish; when not, the next most common cause is unsanitary food preparation practices by a food handler.[1-3] SRSVs are hardy, ubiquitous, and extremely persistent in the environment, resisting disinfection and chlorination, and have been documented to cause serial gastroenteritis outbreaks.[1-3]

Of particular interest in this outbreak were foods prepared by the confection baker on the morning of 26 August when he became ill. Specifically, the crumb cake which he baked on the morning of the 26th and which was served at the breakfast meals on the 26th and 27th, was statistically associated with AGE risk. Contaminated cake frosting was identified as a cause of a large Norwalk viral AGE outbreak in Minnesota in 1982.[4]

Table 2. Odds ratios for selected exposures, 1998 Fort Bliss AGE outbreak

Exposure	Odds Ratio	95% CI
Ate at dining facility (DF) 1 prior to illness	9.8	(2.8, 40.2)
Soft drink	3.8	(2.0, 7.2)
Ate more at DF1 than DF2	3.7	(2.0, 6.9)
In week of outbreak:	**Odds Ratio**	**95% CI**
Crumb cake	2.4	(1.2, 4.8)
Ice cream	1.7	(1.1, 3.0)
Cinnamon roll	1.7	(0.8, 3.7)
Pie	1.5	(0.9, 2.7)
Ice	1.5	(0.8, 2.9)

Ice cream, pie, and cinnamon rolls (prepared by the same baker) were weakly associated with AGE risk. The relatively strong association between the DF1 soda fountain and AGE may indicate cross-contamination of the fountain's surfaces (as SRSVs are resistant to disinfection and can survive on surfaces) or a biological effect of carbonated beverages (as a cofactor) on susceptibility to or clinical expression of ingested SRSV.

In summary, the epidemiologic evidence was considered consistent with a point-source, propagated, food-borne viral illness outbreak in a relatively circumscribed military trainee population. Circumstantial evidence points to contamination of foods in DF1 by a single ill confection baker (although confirmatory diagnostic stool and serum tests were unavailable). Water as a source was ruled out, and a weak association with DF1 ice was statistically non-significant. The use of the Army hospital as a quarantine bay likely decreased secondary propagation of the outbreak.

In spite of high standards in the U.S. food preparation industry, the universal nature and persistence of SRSVs makes recurrences of viral AGE outbreaks a certainty. Prevention of recurrences in U.S. military dining facilities depends upon vigilance and rigorous enforcement of simple measures to prevent food contamination, such as handwashing, dismissal of ill workers from food preparation, serving, dining, and cleanup duties, and basic food sanitation and hygiene measures.

Reported by MAJ Mark Arness, MC, USAF, and LTC Brian Feighner, MC, USA, US Army Center for Health Promotion and Preventive Medicine (USACHPPM), and other members of the EPICON team including MAJ Chris Jenkins and CAPT Tamra Barker, William Beaumont Army Medical Center, Fort Bliss, Texas; LTC Ted Cieslak, US Army Medical Research Institute of Infectious Diseases, Fort Detrick, Maryland; LTC Edward Hoedebecke, Michelle Canham, Christina Polyak, USACHPPM, Aberdeen Proving Ground, Maryland; and Dr. Stephan Monroe, Dr. Rebecca Fankhauser, Viral Gastroenterology Section, Centers for Disease Control and Prevention, Atlanta, Georgia.

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Surveillance trends

Hospitalizations and Outpatient Visits for Musculoskeletal and Connective Tissue Disorders with Emphasis on the Knee, U.S. Army Active Duty, 1997

Hospitalizations, general: Prior to 1997, musculoskeletal system and connective tissue (MSCT) disorders (International Classification of Diseases, 9th Revision, Clinical Modification [ICD-9-CM] codes: 710-739) were consistently the leading causes of hospitalizations of active duty soldiers. In 1997, MSCT disorders accounted for 4,561 soldier hospitalizations (14.6% of the total) and nearly 41 lost person-years (14,945 in-hospital, convalescent leave, and medical hold days) – only hospitalizations related to pregnancies, childbirth, and the puerperium (ICD-9-CM: 630-677) were more frequent (figure 1). In 1997, as in every other year since 1990, more MSCT hospitalizations were associated with "internal derangements of the knee" (ICD-9-CM: 717) (approximately 24% of all MSCT hospitalizations) than any other diagnostic subcategory (figure 2).

Outpatient visits, MSCT-related: In 1997, MSCT disorders accounted for 490,283 (29.4%) of the 1.6 million illness-related clinic visits of active duty soldiers reported through the Standard Ambulatory Data Record (SADR) (figure 1). Armywide, MSCT disorders accounted for more outpatient visits than any other disease or injury-related category. Approximately one-fourth (24.1%) of all MSCT-related outpatient visits were for "other and unspecified disorders of the back" (ICD-9-CM: 724), and visits for "other and unspecified disorders of the joint" (ICD-9-CM: 719) were nearly as frequent (23.2%). Nearly half (45%) of all outpatient visits for "other and unspecified disorders of the joint" (ICD-9-CM 719) were specifically knee-related (e.g., pain, stiffness, swelling, crepitus). In contrast to its preeminence as a cause of MSCT-related hospitalizations, however, "internal derangement of the knee" was a relatively infrequent (4.9%) MSCT-related outpatient diagnosis (figure 2).

Knee disorders, all causes: To identify correlates of "all causes" of knee injury, all MSCT diagnoses that specifically related to the knee were grouped into a single "knee-disorder" category (table, page 12). In 1997, hospitalizations for knee disorders were overwhelmingly due to "internal derangements" (figure 3). Hospitalization

Figure 1. Distributions of hospitalizations and outpatient visits by major diagnostic categories, active duty soldiers, 1997

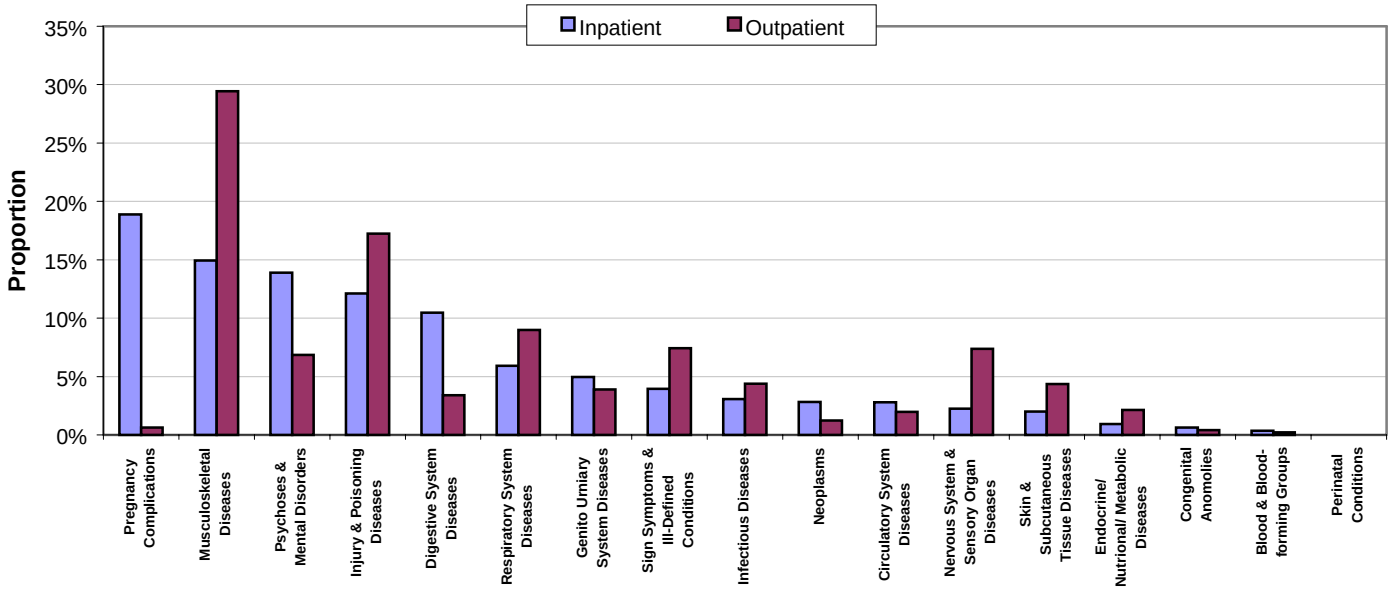


Figure 2. Distributions of musculoskeletal disorder hospitalizations and outpatient visits, by primary diagnosis, active duty soldiers, 1997

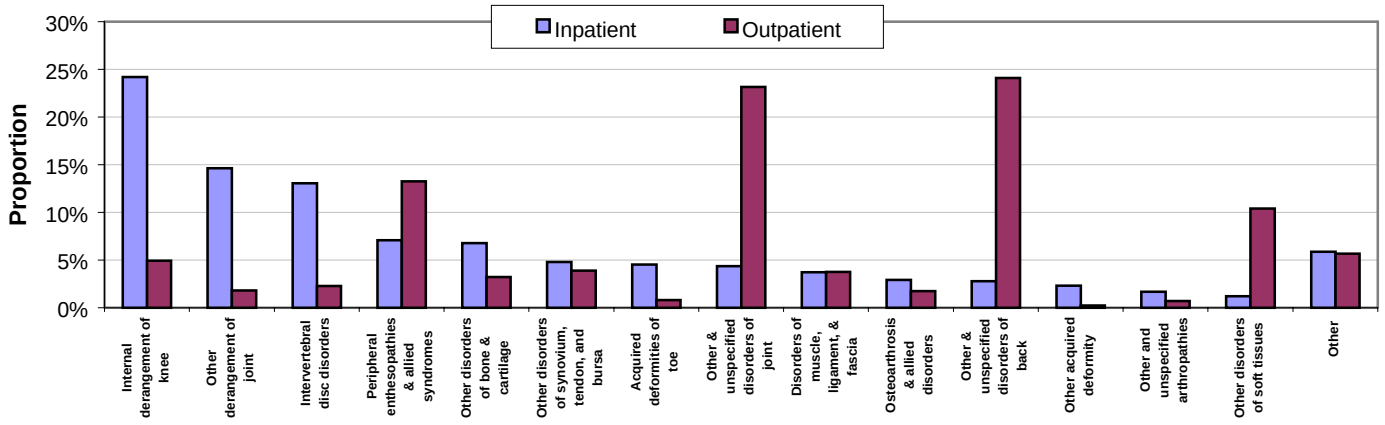


Figure 3. Knee-related hospitalization rates, by gender, active duty soldiers, 1997

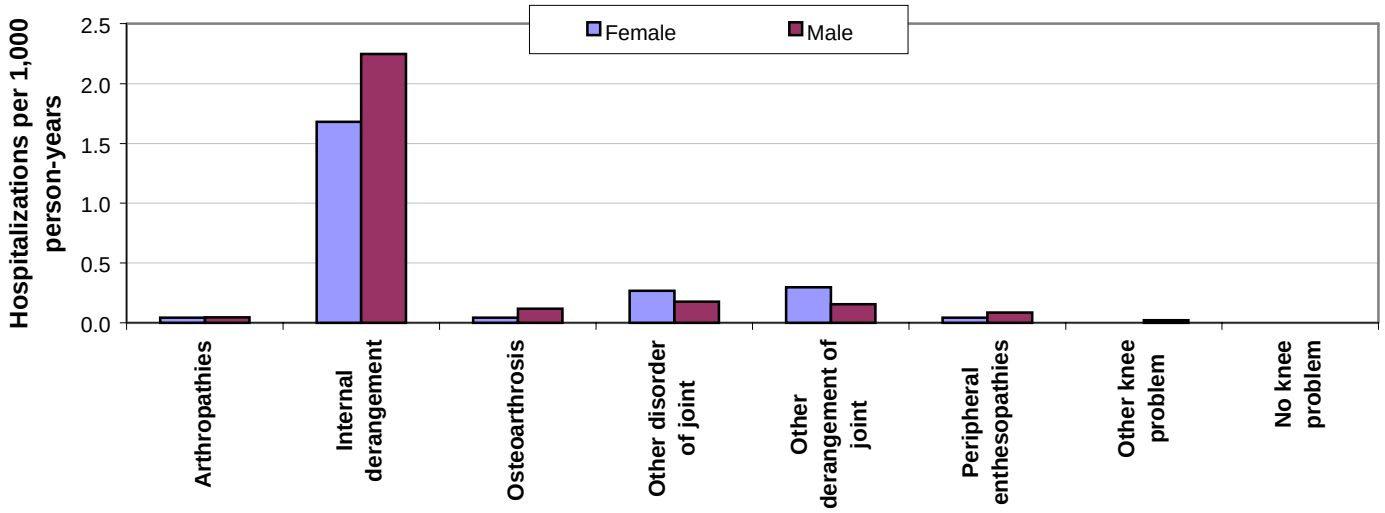
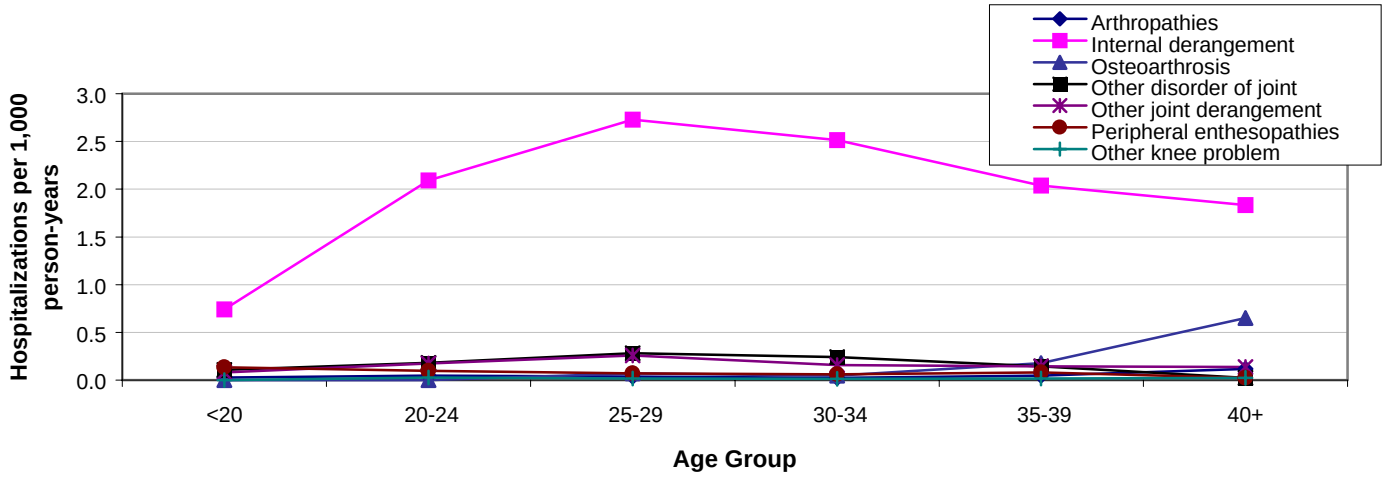


Figure 4. Knee-related hospitalization rates, by age group, active duty soldiers, 1997



rates for "internal derangements" were approximately one-third higher among males than females (males: 2.25 per 1,000 person-years (pers-yrs); females: 1.68 per 1,000 pers-yrs); in contrast, hospitalization rates for other knee disorders did not significantly vary by gender. Hospitalization rates for "internal derangements" also varied with age: rates were lowest among teenaged soldiers, highest among soldiers in their late twenties, and gradually declined with age among soldiers older than 30 (figure 4, page 11). In all age groups except teenagers, hospitalization rates for "internal derangements" were higher among males than females (figure 5).

Knee-related outpatient visit rates were markedly higher among females (outpatient rate: 23.03 per 1,000 person-months [pers-mos]) than males (outpatient rate: 14.36 per 1,000 pers-mos), overall and in all diagnostic subgroups (figure 6) – even clinic visit rates for "internal derangements of the knee" were higher among females than males (in marked contrast to the hospitalization pattern). Clinic visit rates for "other disorders of the joint" – the most frequently reported knee-related outpatient diagnostic subgroup – were highest by far among teenaged soldiers (particularly females) and then markedly declined with age (figures 7 and 8, pages 13 and 14).

Editorial comment: The timely availability of both hospitalization and outpatient medical encounter data provides unprecedented capabilities to conduct military medical surveillance. For example, for the first time, the full spectrum of impacts of specific medical conditions can now be characterized and tracked over time Armywide. As have studies in armies worldwide,[2-8] this report documents the extreme medical and military impacts of musculoskeletal and connective tissue disorders and highlights the prominence within this category of knee problems.

A noteworthy finding of this report is that the most affected subgroups of soldiers, and the major clinical manifestations of knee disorders among them, vary significantly in the outpatient and inpatient settings. For example, knee problems that are

Knee-related diagnoses, all causes, within the musculoskeletal and connective tissue disorders category

ICD-9-CM code	Description
Arthropathies	
711.x6	Arthropathies (of the knee) associated with infections and parasitic diseases
712.x6	Crystal arthropathies (of the knee)
716.x6	Other / unspecified arthropathies (of the knee)
Osteoarthrosis	
715.x6	Osteoarthrosis (of the knee)
Internal derangement of knee	
717.xx	Internal derangement of the knee
Other derangement of joint	
718.x6	Dislocation, contracture, ankylosis, other derangements of the knee
Other and unspecified disorders of joint	
719.x6	Effusion, hemarthrosis, pain, stiffness, difficulty walking, other/unspecified disorders (of the knee)
Peripheral enthesopathies and allied syndromes	
726.x6	Tendonitis, bursitis, unspecified enthesopathies (of knee tendons, ligaments, bursa)
Other knee problems	
727.51	Synovial cyst of popliteal space, Baker's cyst
727.66	Patellar tendon disorder
729.31	Hypertrophy of fat pad; hypertrophy of infrapatellar fat pad (of the knee)
736.x6	Other acquired deformities of knee

Figure 5. Internal derangement of knee hospitalization rates, by age and gender, active duty soldiers, 1997

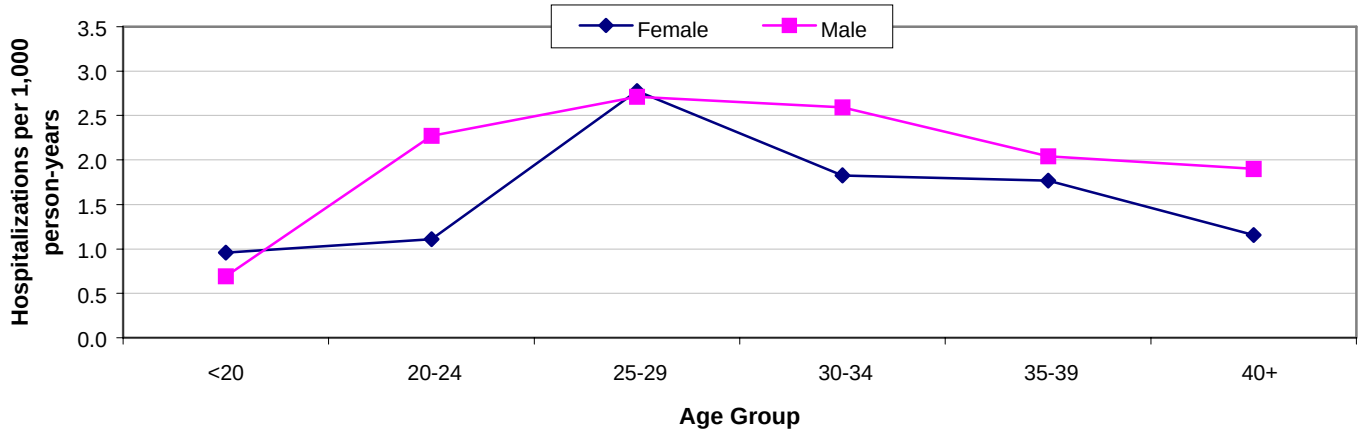


Figure 6. Knee-related outpatient visit rates, by gender, active duty soldiers, 1997

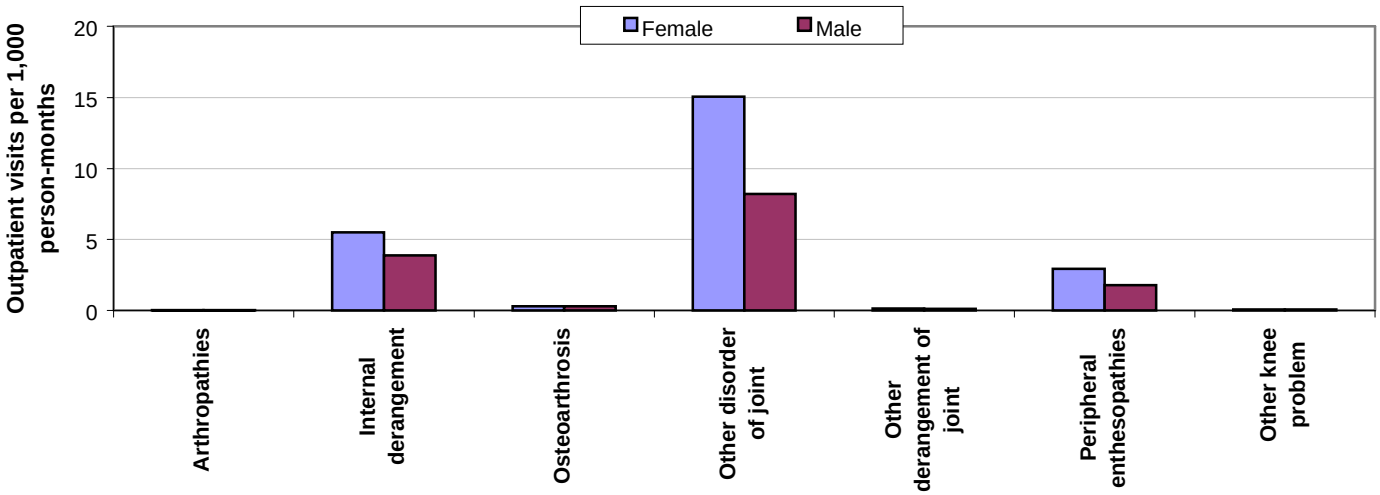


Figure 7. Knee-related outpatient visit rates, by age group, active duty soldiers, 1997

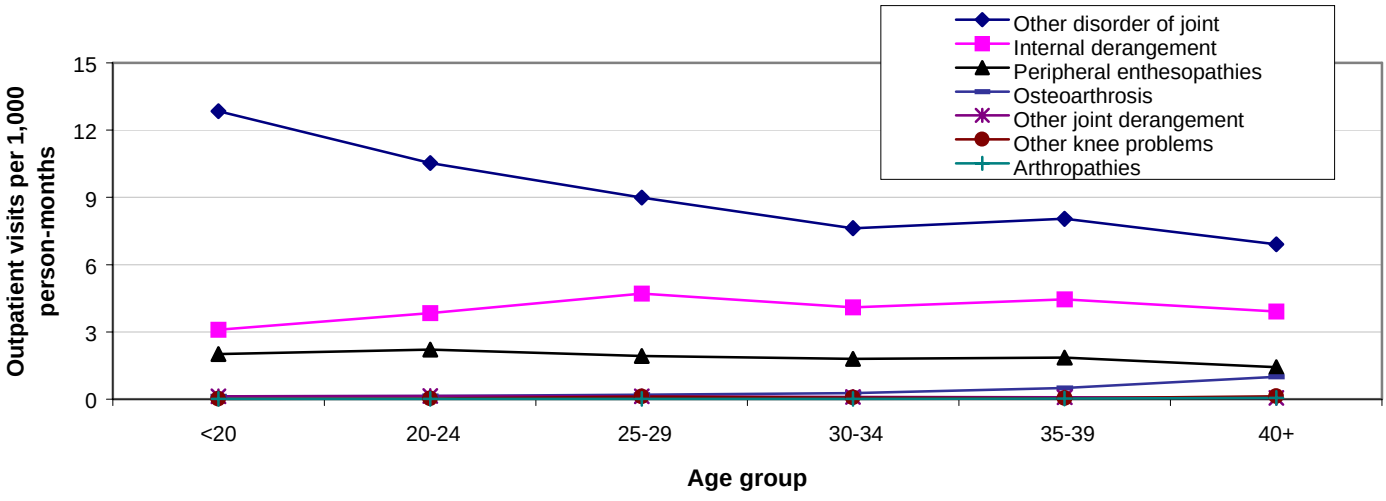
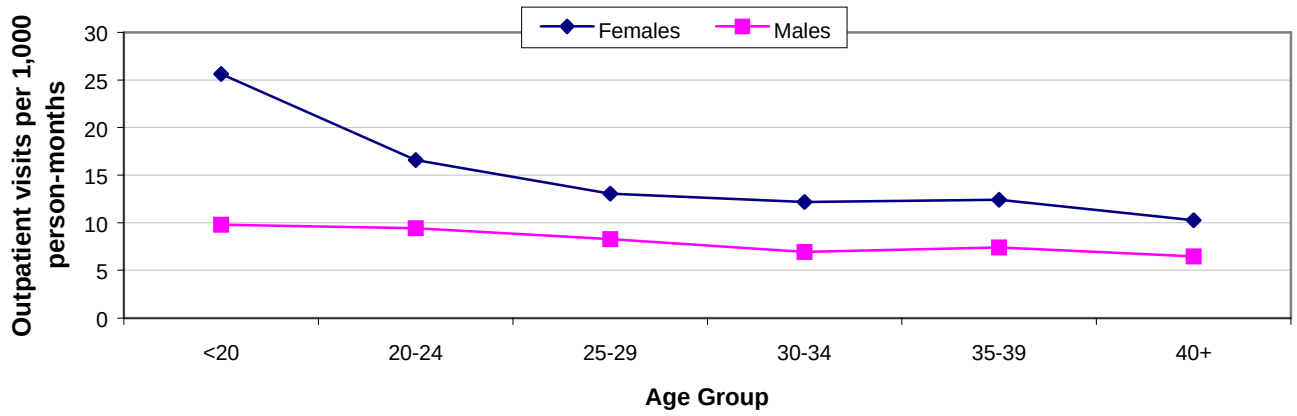


Figure 8. Other and unspecified disorders of joint outpatient visit rates, by age group and gender, active duty soldiers, 1997



treated in outpatient settings generally present with non-specific signs and symptoms (e.g., pain, stiffness, swelling), and young female soldiers are disproportionately affected. A number of studies in other military populations have documented strong relationships between vigorous physical activities (e.g., running, marching, physical training) and high rates of "overuse" knee injuries among new trainees.[4-8] In contrast, knee disorders that are treated in hospitals generally reflect internal structural damage (e.g., torn ligaments/cartilage) that requires surgical repair; male soldiers in mid-career are relatively most affected by this type of problem.

It seems likely that knee disorders that require hospital care result from single or recurrent episodes of trauma (e.g., athletic/military training injuries, motor vehicle accidents)[8] while those that are treated in outpatient clinics largely reflect "overexertion." In turn, to be effective, efforts to prevent knee disorders and their expensive and disruptive consequences should be tailored to specific at-risk subgroups (i.e., teenaged females) in specific high-risk settings (i.e., basic training). Routine, periodic analyses of inpatient and outpatient knee disorder data may help to identify and validate individual risk and precipitating factors, characterize natural histories of various disorders, and describe relative impacts of knee problems (and prevention and control programs) among soldiers.

Report submitted by Karen Campbell, MS, Army Medical Surveillance Activity, USACHPPM.

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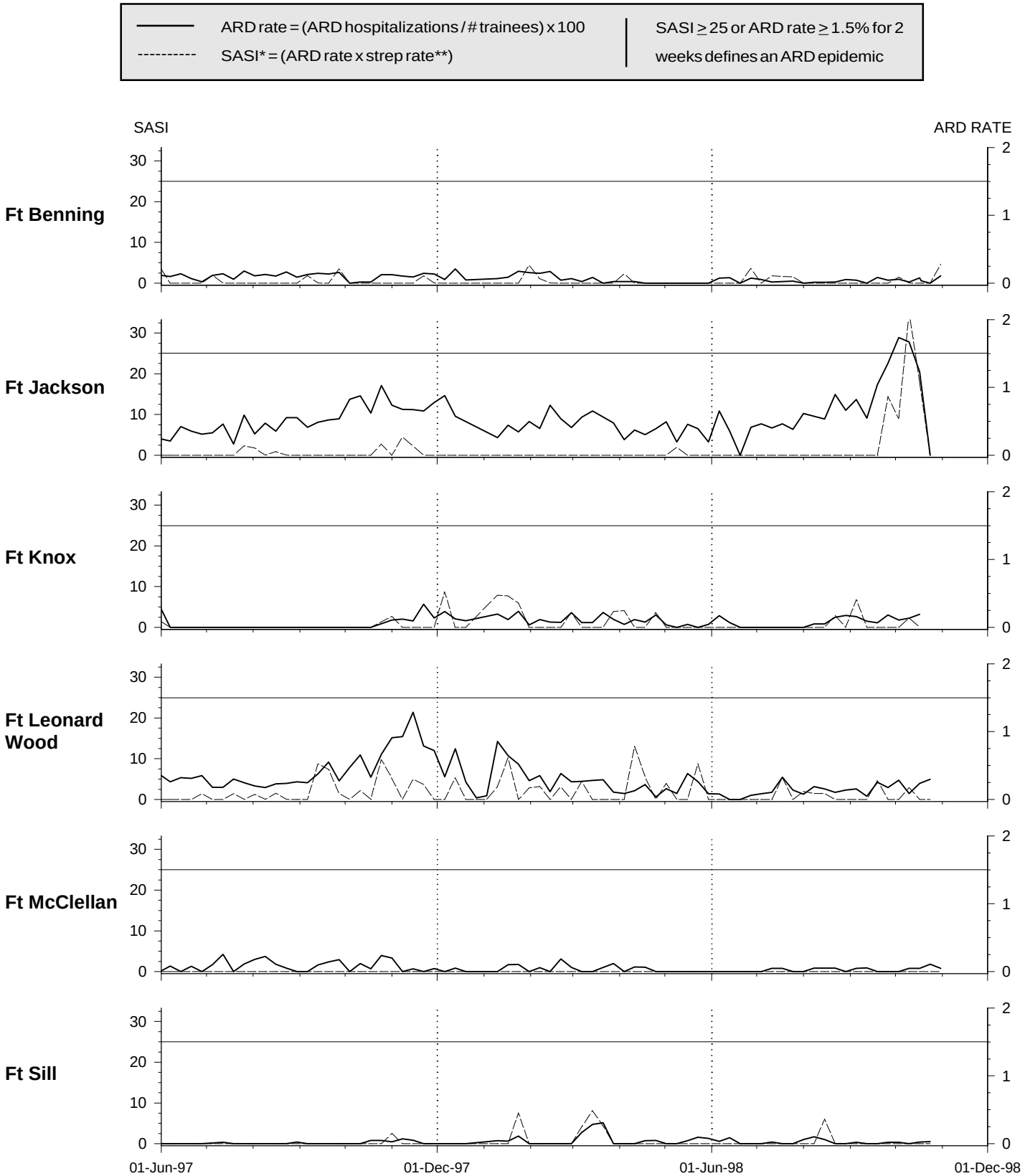
Figure III. Acute respiratory disease (ARD) surveillance update
US Army initial entry training centers



* SASI (Strep ARD Surveillance Index) is a reliable predictor of serious strep-related morbidity

** Strep rate = (Group A beta-hemolytic strep(+) / # cultures) x 100

Surveillance trends

Heat-related Outpatient Visits, Active Duty Soldiers, US Army, January 1997 – August 1998

The past summer (June - August 1998) was the ninth warmest since the United States began detailed national record keeping in 1895.[1] While heat injury prevention programs were challenged throughout the Army, several large installations in the south-central and south-eastern US were particularly stressed. This report summarizes heat-related outpatient visits among active duty soldiers (as reported through the DoD Standard Ambulatory Data Record) from January 1997 to August 1998.

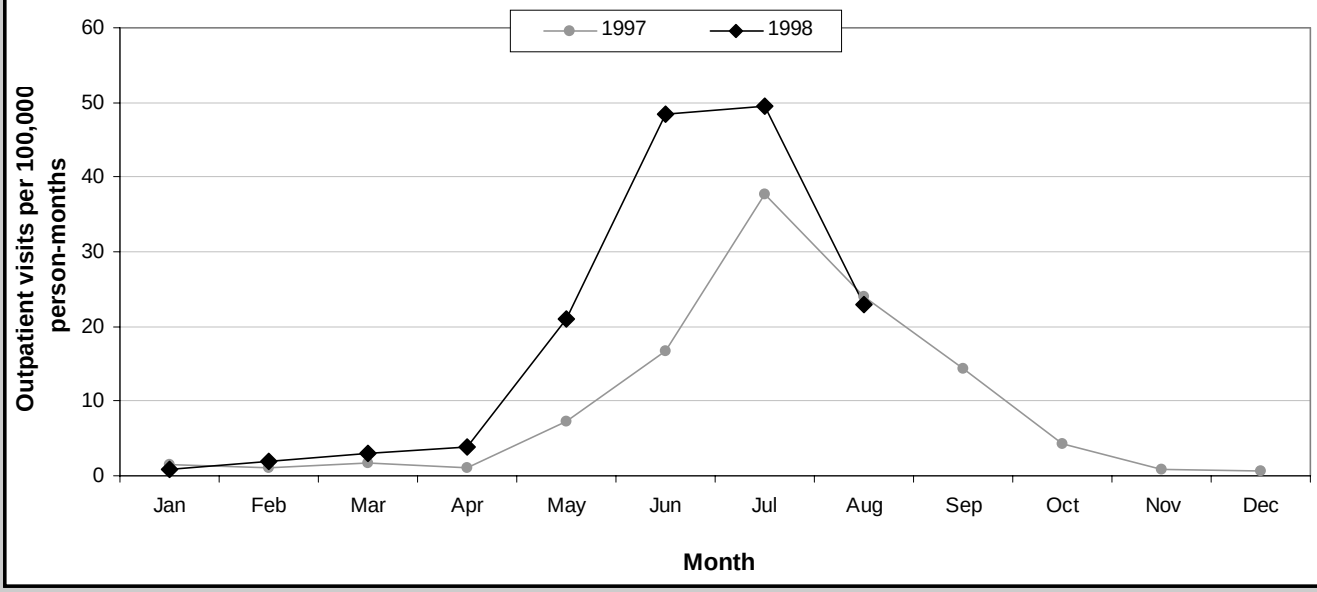
General: One thousand two hundred and fifty-two soldiers accounted for 1,433 heat-related outpatient visits between January 1997 and August 1998 (for the remainder of this report, only the first of multiple heat-related visits of individual soldiers are included). Armywide, heat-related visit rates were more than 50% higher during the summer of 1998 (40 per 100,000 person-months [pers-mos]) compared to the summer of 1997 (26 per 100,000 pers-mos) (figure 1). In both 1997 and 1998, heat-related visit rates substantially increased in May and peaked in July. There were nearly three-times more heat-related visits in June 1998 (the hottest June in US weather history) compared to June 1997; furthermore, in 1998 (but not in 1997), heat-related visit rates in June were nearly as high as in July.

Among heat-related outpatient visits, 60% were reported as "heat exhaustion," 13% as "heat cramps," 8% as "heat stroke," and 4% as "syncope" — the remaining approximately 15% had nonspecific diagnoses.

Four large installations in the southeastern US — Fort Benning, Georgia; Fort Bragg, North Carolina; Fort Campbell, Kentucky; and Fort Polk, Louisiana — accounted for 61% of all Army cases. In both 1997 (n=125) and 1998 (n=185), Fort Benning, the Army's infantry training center, reported more heat-related clinic visits than any other Army post.

Gender: Heat-related visit rates were higher among females than males; however, rates increased between 1997 and 1998 more among

Figure 1. Heat injury outpatient visit rates, by month, active duty soldiers, 1997-1998



males (1997: 8.6 per 100,000 pers-mos; 1998: 12.0 per 100,000 pers-mos; rate ratio, 98:97: 1.40) than females (1997: 12.8 per 100,000 pers-mos; 1998: 15.8 per 100,000 pers-mos; rate ratio, 98:97: 1.23).

Race/ethnicity: For this summary, soldiers were divided into four race/ethnicity-defined subgroups: "white, not hispanic," "black, not hispanic," "hispanic," and "others." Hispanic soldiers had much higher – and "others" much lower – heat-associated visit rates than either white or black soldiers. Rates increased from 1997 to 1998 in all race/ethnicity-defined subgroups; however, by far the largest rate increase occurred among hispanic soldiers (figure 2).

Age: There was a strong inverse relationship between age and heat-related visit rates. The highest rates in general, and the largest absolute increase in rates between 1997 and 1998, occurred among teenaged soldiers (figure 3).

Military grade, occupation: The heat-related visit rate among enlisted soldiers (23.7 per 100,000 pers-mos) was more than twice that among officers (11.7 per 100,000 pers-mos) (table 1). Among enlisted soldiers, the highest rate occurred in the occupational group[2] that included initial entry ("basic") trainees. Among officers, the highest rate occurred in the "tactical operations" subgroup (table 2, page 18).

Residence prior to entering Army service: Military Entrance Processing Station (MEPS) records documented states of residence prior to entering Army service for 1,134 (90%) of the 1,257 outpatient heat cases. Expected numbers of cases, by state, were estimated by multiplying the total number of heat-related cases by the proportions of soldiers who resided in the various states prior to joining the Army. Observed and expected numbers of cases were then compared to identify states that

Figure 2. Heat injury outpatient visit rates, by race/ethnicity, active duty soldiers, 1997-1998

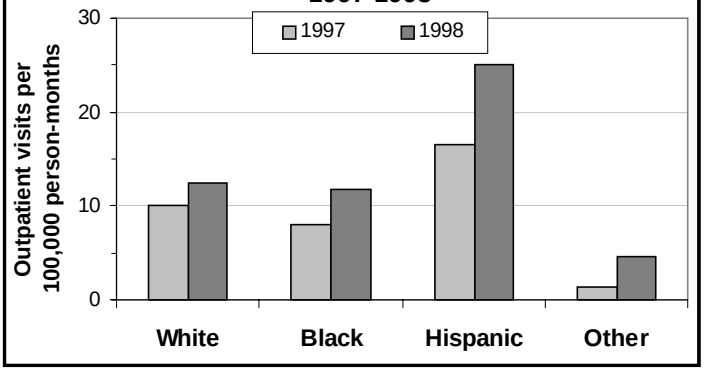


Table 1. Heat injury outpatient visit rates*, by rank group, active duty soldiers, 1997-1998

	1997	1998
PVT (E1) - CPL (E4)	15.3	20.2
SGT (E5) - SGM(E9)	4.7	6.4
2LT (O1) - CPT (O3), WO (W1-W3)	6.6	8.8
MAJ (O4) - LTG (O9), WO (W4-W5)	1.5	1.8

* Rates are calculated as outpatient visits per 100,000 person-months

Figure 3. Heat injury outpatient visit rates, by age group, active duty soldiers, 1997-1998

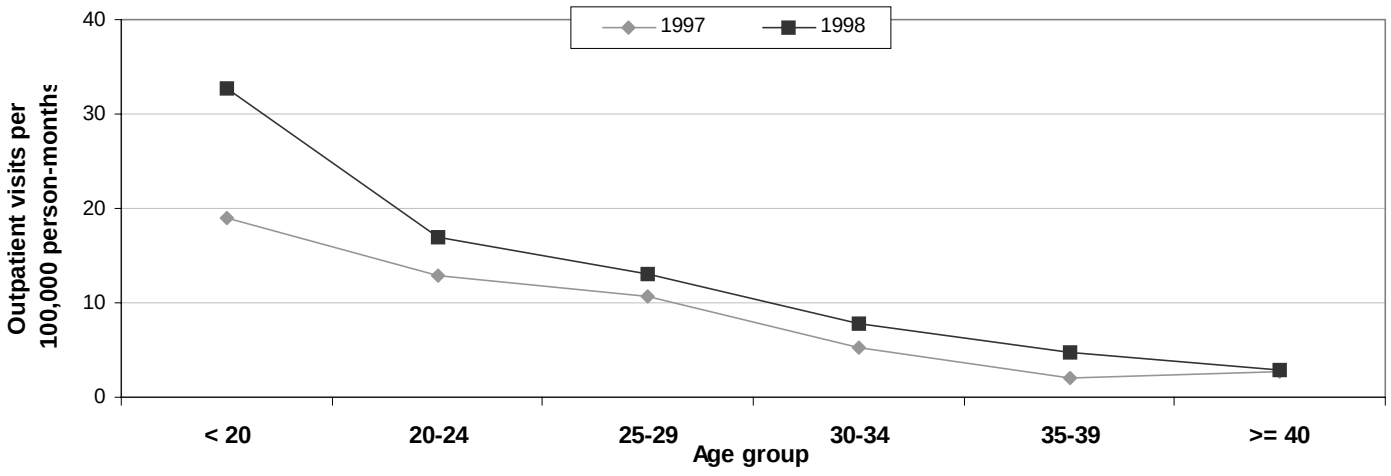


Table 2. Heat injury outpatient visits, by occupation group, active duty soldiers, 1997-1998

	Number of cases	Outpatient visits per 100,000 person-months
Enlisted		
Infantry,gun crews,seamanship	384	31
Electronic equipment repairers	57	17
Communications and intelligence	96	19
Health care specialists	95	23
Other technical and allied spec.	41	26
Functional support and admin.	107	14
Elec./mech. equipment repairers	138	20
Craftsworkers	34	35
Service and supply handlers	150	25
Non-occupational (e.g., trainees)	45	134
Sub-total (enlisted)	1147	24
Officer		
Generals and executives, NEC	0	
Tactical operations officers	63	16
Intelligence officers	2	3
Engineering and maintenance	13	11
Scientists and professional	5	14
Health care officers	14	8
Administrators	6	11
Supply, procurement and allied	7	7
Non-occupational	0	0
Other	0	0
Sub-total (officers)	110	12

were significantly over- or underrepresented among heat-related cases. Soldiers from Indiana were significantly overrepresented among heat cases while soldiers from Georgia, Hawaii, and Pennsylvania were significantly underrepresented. Interestingly, soldiers from Alaska were significantly overrepresented among heat cases at Fort Benning, the post with the highest number of heat-related cases.

Editorial Comment: The summer of 1998 was associated with heat and drought conditions of historic significance throughout much of the US. It should not be surprising therefore that heat-related outpatient visits were more frequent Armywide in 1998 compared to 1997 and that large posts in the southern US were disproportionately affected.

Over the past two years, hispanic and teenaged soldiers had significantly higher rates of heat-related outpatient visits than their counterparts. In previous analyses, these subgroups were also overrepresented among soldiers who were hospitalized for heat-related conditions.[3] Finally, during the summer of 1998, heat-related visit rates among teenaged and hispanic soldiers increased much more than among other racial/ethnic or age-defined subgroups. These findings suggest that, at least in US Army service, soldiers in their first terms of enlistment and those of hispanic ethnicity are at increased heat-injury risk.

While male and female soldiers had similar heat-related hospitalization experiences, females were much more likely than males to have heat-related outpatients visits. Of interest, higher pro-

portions of males than females were diagnosed with “heat stroke” or “heat cramps” while females were relatively more likely than males to be diagnosed with “heat exhaustion” or “heat injury of unspecified type" (figure 4). Finally, males who presented with heat injuries as outpatients were more likely than females to be “referred to a specialist” and/or to be hospitalized (figure 5). Together, these data suggest that females may seek medical care earlier in the courses of their heat-related illnesses, and, thus, may receive less specific diagnoses, require less time and resources consuming resuscitative care, and return to duty more quickly than males.

Finally, in both 1997 and 1998, heat-related visit rates significantly increased in May, and rates in May generally indicated the magnitudes of subsequent June through August epidemics. To optimize heat-injury prevention program performance, post medical staffs, training cadres, unit commanders, and enlisted leaders – especially those at large training posts — should develop and implement heat-injury prevention programs in the late winter-early spring (rather than the late spring-early summer) months.

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Figure 4. Heat injury outpatient visits, by gender and diagnosis, active duty soldiers, 1997-1998

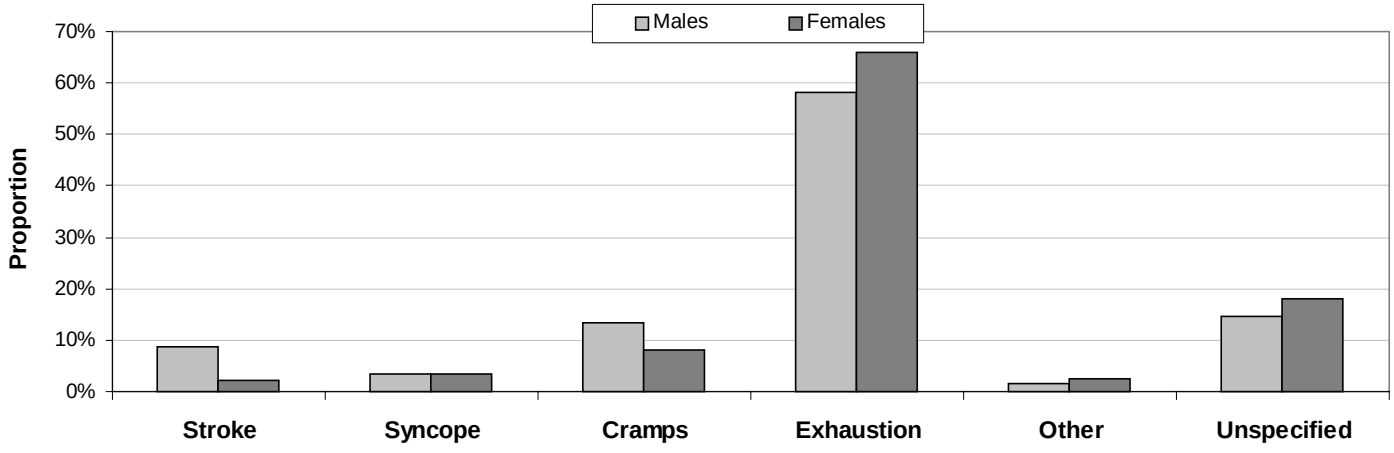
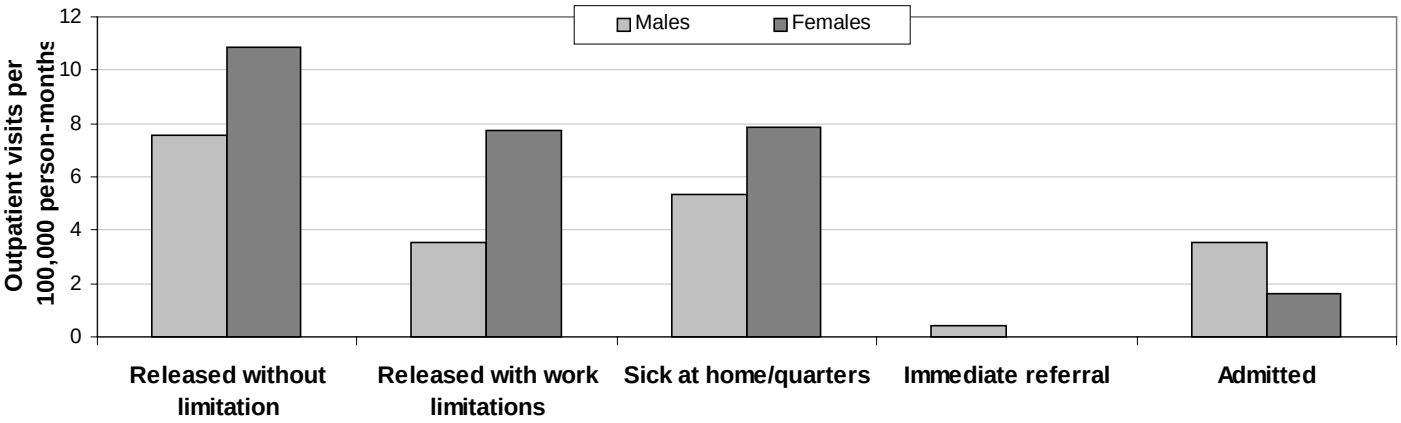


Figure 5. Heat injury outpatient visit rates, by gender and disposition, active duty soldiers, 1997-1998



Supplement #1: Reportable Disease

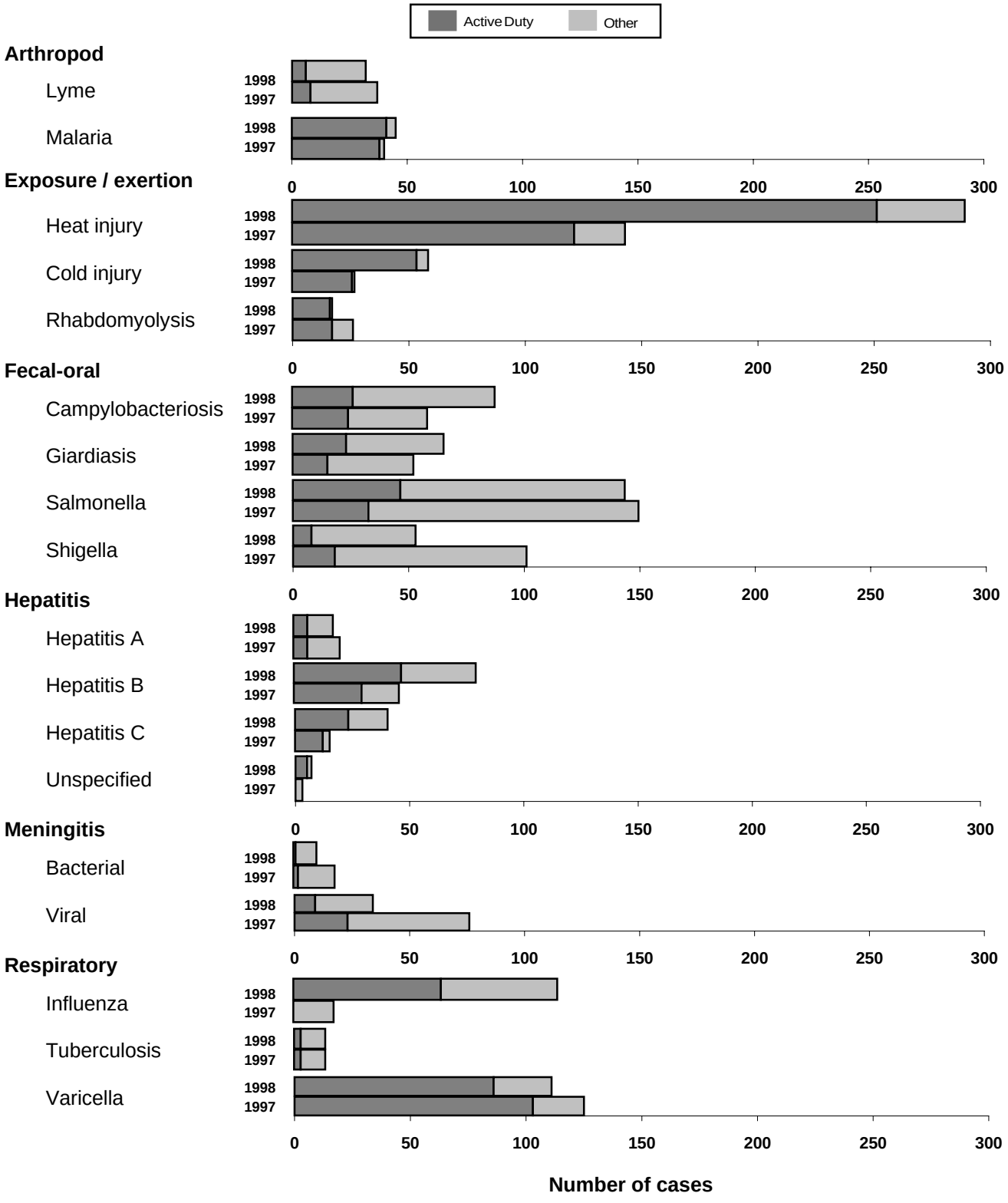
TABLE S1. Reportable conditions reported through Medical Surveillance System, Jan-Sep 1998*

Diagnosis	1st Quarter	2nd Quarter	3rd Quarter	Total	Diagnosis	1st Quarter	2nd Quarter	3rd Quarter	Total
Amebiasis	0	1	0	**1**	Malaria, falciparum	0	0	1	**1**
Anthrax	0	0	0	**0**	Malaria, malariae	0	0	0	**0**
Arboviral fever, unsp.	0	0	0	**0**	Malaria, ovale	0	2	0	**2**
Asbestosis	0	8	0	**8**	Malaria, unspecified	0	1	6	**7**
Botulism	0	1	0	**1**	Malaria, vivax	2	9	24	**35**
Brucellosis	0	0	0	**0**	Measles	4	2	1	**7**
Campylobacteriosis	16	31	40	**87**	Meningitis, Viral	14	10	12	**36**
Carbon monoxide intx.	5	0	1	**6**	Meningitis, Bact.	6	6	10	**22**
Chancroid	0	0	0	**0**	Mercury intoxication	0	0	0	**0**
Chemical agent exp.	0	1	0	**1**	Mumps (adults only)	3	1	0	**4**
Chlamydia	1689	1514	1537	**4740**	Mycobacterial inf.	3	2	0	**5**
Cholera	0	1	0	**1**	Pertussis	2	5	0	**7**
Coccidioidomycosis	0	2	0	**2**	Plague	0	0	0	**0**
CWI, frostbite	39	1	0	**40**	Pneumococcal pneum.	3	0	1	**4**
CWI, hypothermia	6	0	0	**6**	Poliomyelitis	0	0	0	**0**
CWI, immersion type	8	0	0	**8**	Psittacosis	0	0	0	**0**
CWI, unspecified	4	1	0	**5**	Q fever	0	0	0	**0**
Dengue fever	0	1	2	**3**	Rabies, human	0	0	0	**0**
Diphtheria	0	0	0	**0**	Radiation injury	0	0	0	**0**
Ehrlichiosis	0	0	1	**1**	Relapsing fever	0	0	0	**0**
Encephalitis	0	0	0	**0**	Reye syndrome	0	0	0	**0**
Giardiasis	21	12	32	**65**	Rhabdomyolysis	10	7	0	**17**
Gonorrhea	554	484	522	**1560**	Rheumatic fever	1	0	0	**1**
Granuloma Inguinale	1	0	0	**1**	Rift Valley Fever	0	0	0	**0**
Guillain-Barre Syndrome	1	2	0	**3**	RMSF	0	3	2	**5**
H. influenzae, inv.	1	0	0	**1**	Rubella	0	0	0	**0**
Heat exhaustion	6	82	118	**206**	Salmonellosis	35	55	55	**145**
Heat stroke	0	14	42	**56**	Schistosomiasis	0	0	0	**0**
Hemorrhagic fever	0	0	0	**0**	Shigellosis	18	16	20	**54**
Hepatitis A, Acute	6	7	4	**17**	Syphilis, congenital	0	0	1	**1**
Hepatitis B, Acute	27	23	28	**78**	Syphilis, tertiary	0	3	2	**5**
Hepatitis C, Acute	16	11	13	**40**	Syphilis, latent	2	10	6	**18**
Hepatitis, unspec.	5	2	0	**7**	Syphilis, prim/sec	7	10	15	**32**
Herpes Simplex	231	145	70	**446**	Syphilis, unspec.	12	13	0	**25**
Influenza	116	0	2	**118**	Tetanus	1	0	0	**1**
Kawasaki syndrome	4	2	0	**6**	Toxic shock syndrome	2	1	1	**4**
Lead poisoning	1	1	1	**3**	Toxoplasmosis	0	0	0	**0**
Legionellosis	0	0	0	**0**	Trichinellosis	0	1	0	**1**
Leish, cutaneous	3	0	0	**3**	Trypanosomiasis, Afr.	0	0	0	**0**
Leish, mucocutaneous	0	0	0	**0**	Trypanosomiasis, Amer.	0	0	0	**0**
Leish, unspecified	0	0	0	**0**	Tuberculosis, pulmonary	5	6	3	**14**
Leish, visceral	0	0	1	**1**	Tularemia	0	0	0	**0**
Leish, viscerotropic	0	0	0	**0**	Typhoid fever	0	0	0	**0**
Leprosy	0	0	0	**0**	Typhus fever	0	0	0	**0**
Leptospirosis	0	0	0	**0**	Urethritis, non-specific	253	224	185	**662**
Listeriosis	0	0	0	**0**	Vaccine advrs event	0	4	5	**9**
Lyme disease	4	10	18	**32**	Varicella,adult only	73	30	1	**104**
Lymphogranuloma Vnrm	0	0	0	**0**	Yellow fever	0	0	0	**0**
					Total	**3220**	**2778**	**2783**	**8781**

* Based on date of onset.

Date of report: 7-Nov-98

FIGURE S1. Sentinel reportable diseases, United States Army*
Comparison of first nine months of calendar year 1998 and 1997

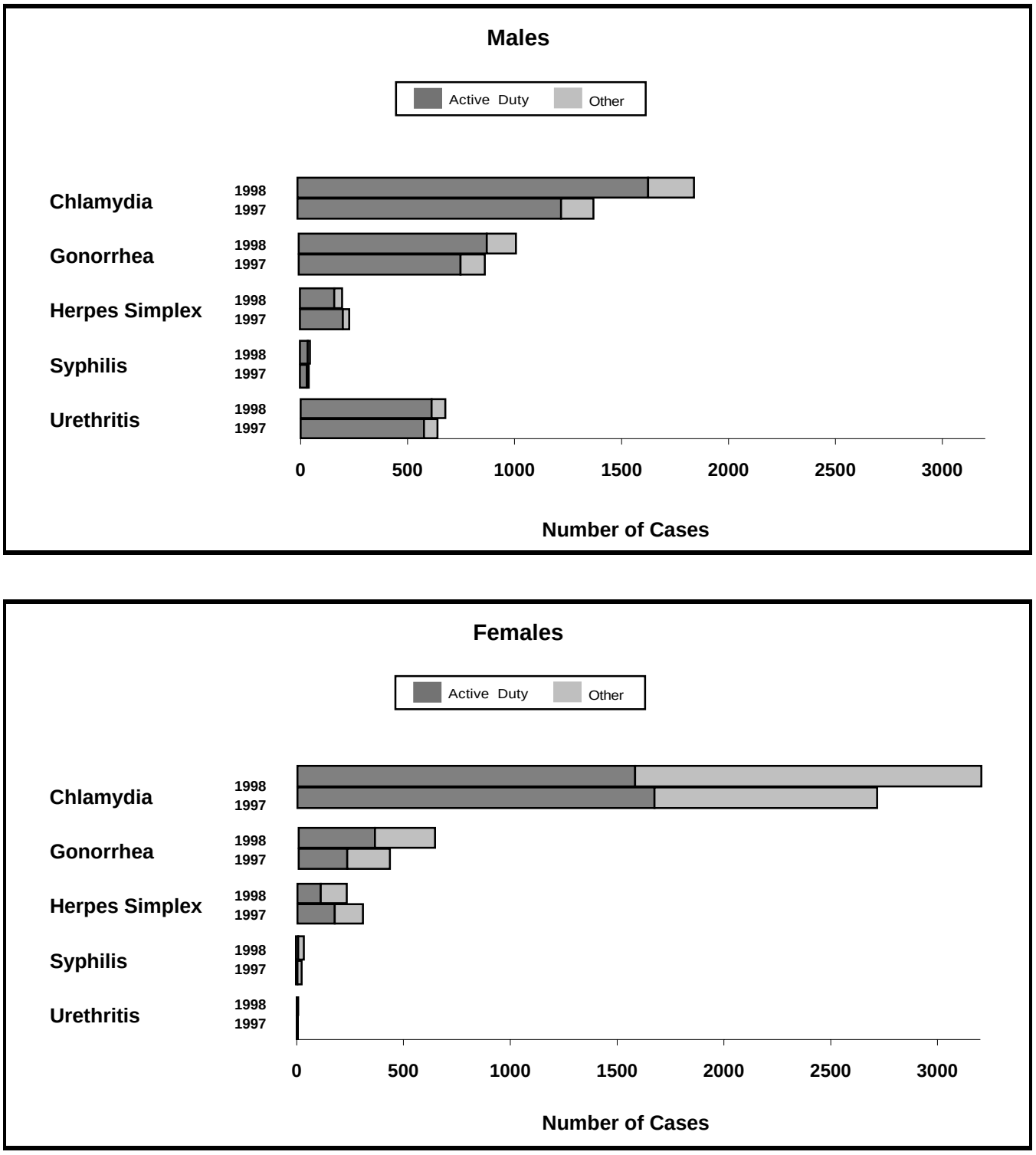


* Based on date of onset.

** Reports are included from main and satellite clinics. Not all sites reporting.

Date of Report: 7-Nov-98

FIGURE S2. Sentinel reportable STDs, United States Army*
Comparison of first nine months, by gender, calendar years 1998 and 1997



* Based on date of onset.

** Reports are included from main and satellite clinics. Not all sites reporting.

Date of Report: 7-Nov-98

TABLE S2. Active duty force strength by MTF, United States Army, June, 1998*

MTF/Post**	Males							Females							All
	< 20	20-24	25-29	30-34	35-39	>= 40	Total M	< 20	20-24	25-29	30-34	35-39	>= 40	Total F	
NORTH ATLANTIC RMC															
Walter Reed AMC	189	1331	1401	1493	1738	3040	**9192**	54	410	561	511	488	579	**2603**	**11795**
Aberdeen Prov. Ground, MD	160	400	249	340	395	368	**1912**	36	82	78	62	44	40	**342**	**2254**
FT Belvoir, VA	16	194	288	317	313	396	**1524**	8	85	131	86	93	60	**463**	**1987**
FT Bragg, NC	1953	11520	8624	6218	4110	2362	**34787**	356	1618	1257	685	438	252	**4606**	**39393**
FT Drum, NY	762	3521	2322	1380	947	461	**9393**	114	472	237	149	77	50	**1099**	**10492**
FT Eustis, VA	304	1400	1228	962	888	798	**5580**	111	472	332	178	155	109	**1357**	**6937**
FT Knox, KY	921	2353	1474	1370	1394	812	**8324**	49	226	178	144	92	78	**767**	**9091**
FT Lee, VA	433	935	719	619	474	387	**3567**	249	438	266	193	126	87	**1359**	**4926**
FT Meade, MD	97	737	1033	956	696	836	**4355**	50	296	331	225	186	168	**1256**	**5611**
West Point, NY	28	257	274	671	578	583	**2391**	9	59	64	116	84	66	**398**	**2789**
GREAT PLAINS RMC															
Brooke AMC	164	755	930	1043	812	933	**4637**	150	373	457	361	288	299	**1928**	**6565**
Wm Beaumont AMC	526	2536	1865	1350	1076	1012	**8365**	153	713	449	220	161	146	**1842**	**10207**
FT Carson, CO	763	4482	3326	2134	1593	839	**13137**	171	742	442	240	174	104	**1873**	**15010**
FT Hood, TX	2575	13239	8667	5468	3779	2253	**35981**	521	2385	1587	872	627	334	**6326**	**42307**
FT Huachuca, AZ	225	942	968	748	642	424	**3949**	121	331	220	138	140	93	**1043**	**4992**
FT Leavenworth, KS	83	260	246	420	776	567	**2352**	35	101	71	72	91	53	**423**	**2775**
FT Leonard Wood, MO	1011	1094	955	1000	831	482	**5373**	326	387	285	163	106	59	**1326**	**6699**
FT Polk, LA	409	2567	1714	1298	795	398	**7181**	99	458	250	155	98	53	**1113**	**8294**
FT Riley, KS	783	3782	2224	1283	883	454	**9409**	105	479	262	153	91	60	**1150**	**10559**
FT Sill, OK	1406	3880	2536	1693	1309	805	**11629**	133	439	306	189	118	87	**1272**	**12901**
Panama	44	482	558	483	409	299	**2275**	12	71	78	43	26	18	**248**	**2523**
SOUTHEAST RMC															
Eisenhower AMC	759	1904	1495	1175	1257	1163	**7753**	206	559	464	338	342	242	**2151**	**9904**
FT Benning, GA	2536	5475	3463	2111	1403	741	**15729**	126	494	388	219	152	73	**1452**	**17181**
FT Campbell, KY	1190	6965	5570	3439	2296	1080	**20540**	206	1031	674	400	234	104	**2649**	**23189**
FT Jackson, SC	1626	1454	774	910	708	440	**5912**	842	699	369	303	176	92	**2481**	**8393**
FT McClellan, AL	500	597	446	558	508	423	**3032**	232	248	150	115	92	56	**893**	**3925**
FT Rucker, AL	68	584	1059	637	472	429	**3249**	53	203	142	58	62	30	**548**	**3797**
FT Stewart, GA	1163	6032	4236	2587	1873	993	**16884**	206	1046	717	374	246	121	**2710**	**19594**
WESTERN RMC															
Madigan AMC	992	5006	3784	2553	1907	1265	**15507**	192	845	618	341	223	214	**2433**	**17940**
FT Irwin, CA	252	1300	894	740	534	277	**3997**	37	163	128	70	51	33	**482**	**4479**
FT Wainwright, AK	296	2001	1782	985	645	336	**6045**	38	310	245	148	113	56	**910**	**6955**
OTHER LOCATIONS															
Tripler AMC	510	4019	3384	2106	1522	983	**12524**	136	744	708	407	281	203	**2479**	**15003**
Europe	2252	16353	14400	9234	6580	4370	**53189**	556	3259	2459	1450	1030	607	**9361**	**62550**
Korea	1890	8343	6188	4494	3406	2275	**26596**	464	1481	1157	664	544	297	**4607**	**31203**
Other/Unknown	1800	4957	5333	7108	5634	3939	**28771**	425	1113	939	783	725	400	**4385**	**47453§**
Total	**28686**	**121657**	**94409**	**69883**	**53183**	**37223**	**405041**	**6581**	**22832**	**17000**	**10625**	**7974**	**5323**	**70335**	**476888**

* Based on duty zip code. Does not account for TDY.

** Includes any subordinate catchment areas not listed separately.

§ Includes unknown age groups and unknown gender.

Source: Defense Manpower Data Center (DMDC)

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